

Jet energy correction using weights on calorimeters readout

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All calculations were carried out with cmsim120

Calorimeter geometry:

Barrel: **ECAL+HB1+HB2+HB3+tailcatcher**

Endcap: **ECAL+HE1+HE2+HE3**

Calibration constants for HCAl (determined for Et=50 GeV pions)

Barrel: **118E5, 147E5, 147E5, 150E5**

Endcap: **156E5, 220E5, 220E5**

Energy threshold for ECAL:

Barrel: **Et=30 MeV/crystal**

Endcap: **E=150 MeV/crystal**

Calibration procedure

Min bias events have been generated with PYTHIA6.152 and parameters using for autumn Jet/MET production run.

Jets were found on generation level with simple cone algorithm LUCELL with two different radii: **R=0.5 and R=1.**

Jets were found on calorimeter level with modified window algorithm using default calibration coefficients. Two radii: **R=0.5 and R=1.**

Minimisation of **two different functionals** was performed for different radii of jet finder algorithm.

Minimisation of functionals:

Fit1:

$$S1 = \sqrt{\frac{\sum (E_{T\ jet_i}^{rec} - E_{T\ jet_i}^{gen})^2}{(Nevent - 1)}}$$

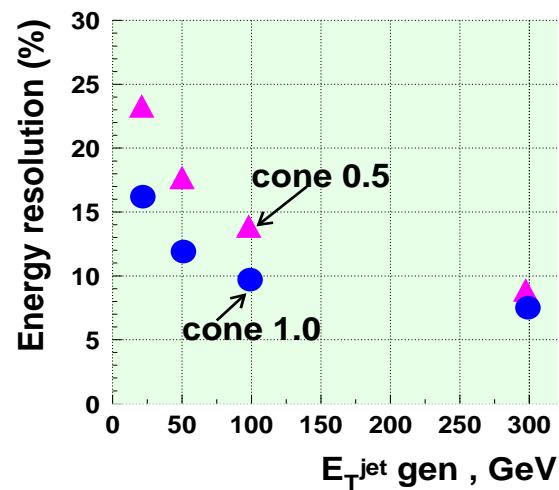
Fit2:

$$S2 = \frac{S1}{\left\langle \frac{E_{T\ jet}^{rec}}{E_{T\ jet}^{gen}} \right\rangle}$$

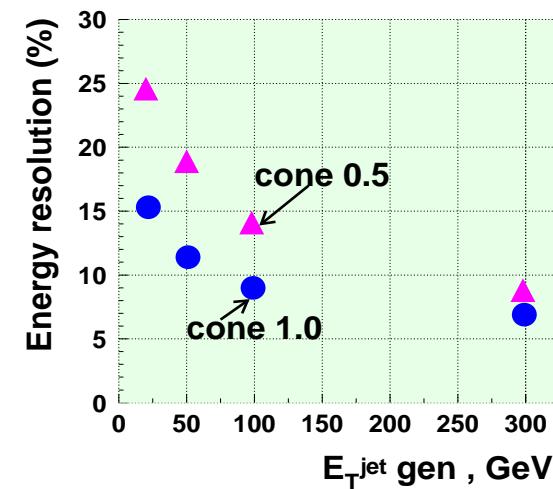
Where:

$$E_{T\ jet_i}^{rec} = a * ECAL + \sum b_j * HB_j + \sum c_j * HE_j$$

Resolution for different radii of algorithm with coefficients obtained by fit2.

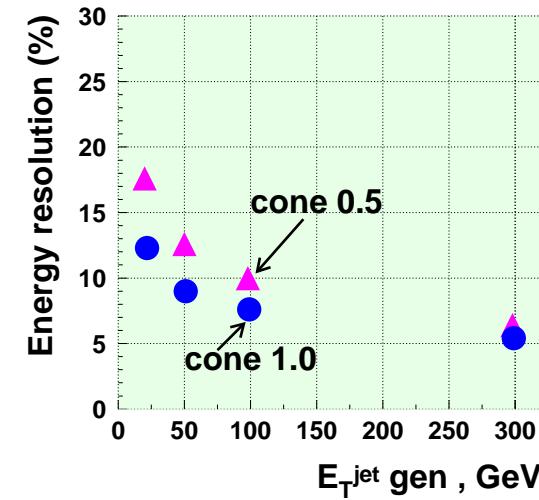


$|\eta| < 0.3$



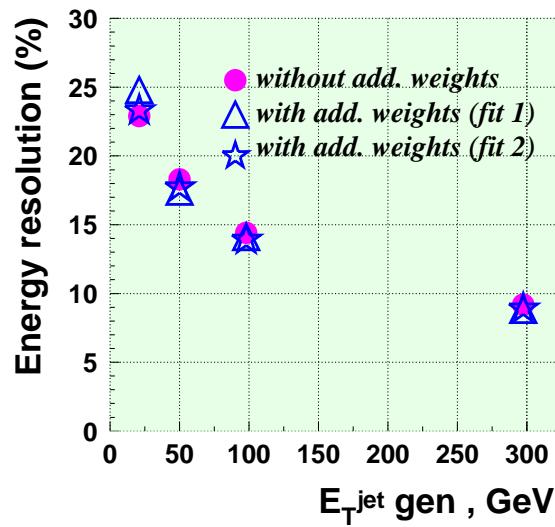
$0.6 < \eta < 0.9$

$$resolution = \frac{\left(\sigma \left(\frac{E_{T \, jet}^{rec}}{E_{T \, jet}^{gen}} \right) \right)}{\left\langle \frac{E_{T \, jet}^{rec}}{E_{T \, jet}^{gen}} \right\rangle}$$

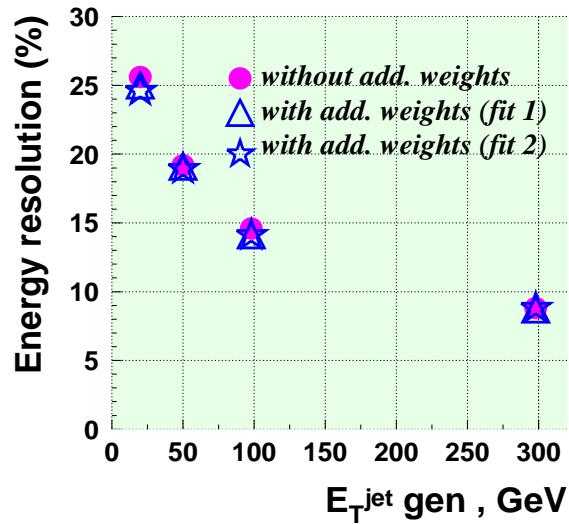


$1.8 < \eta < 2.1$

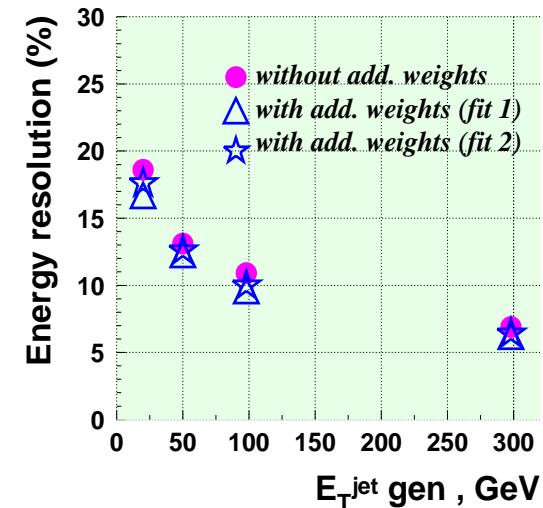
Dependance of resolution from energy for algorithm radius 0.5



$|\eta| < 0.3$



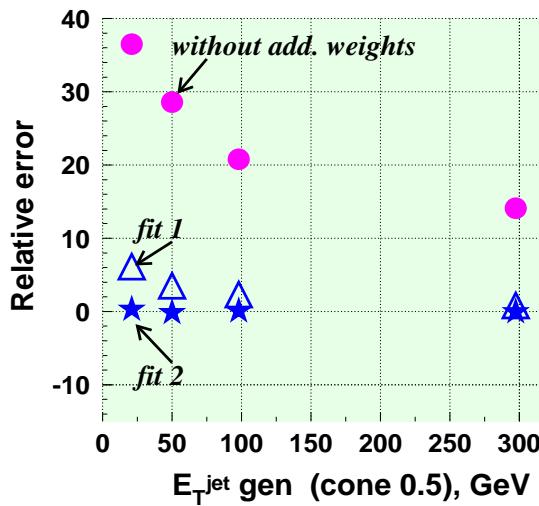
$0.6 < |\eta| < 0.9$



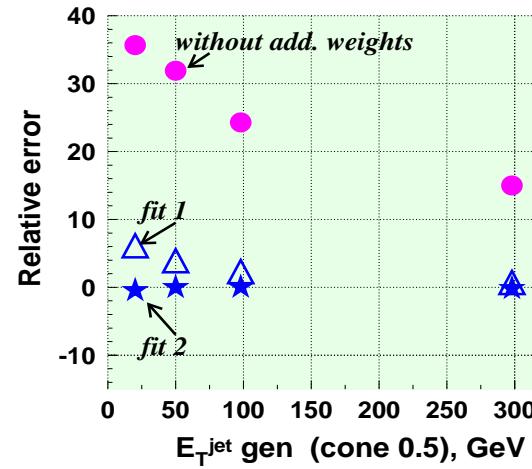
$1.8 < |\eta| < 2.1$

Relative error for R=0.5

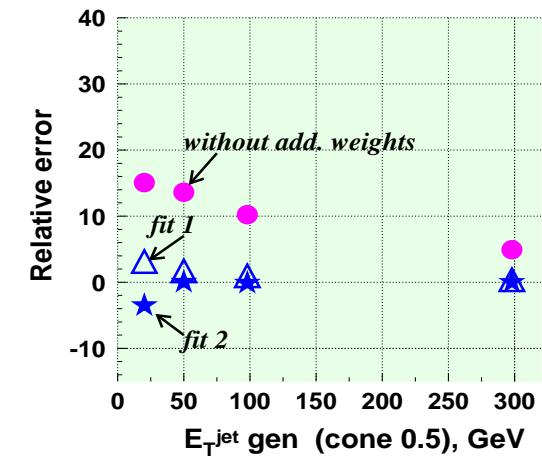
$$error = \frac{\langle E_{T\ jet}^{rec} - E_{T\ jet}^{gen} \rangle}{\langle E_{T\ jet}^{rec} \rangle}$$



$|\eta| < 0.3$



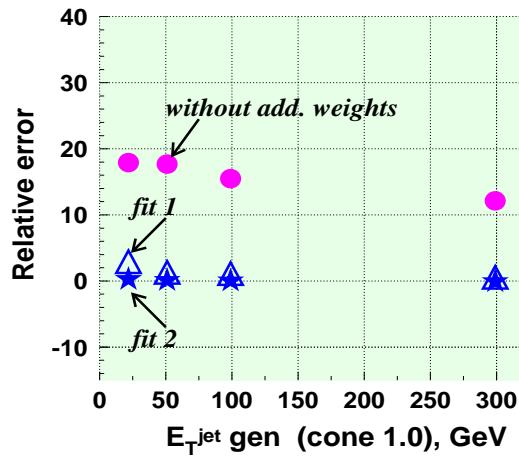
$0.6 < |\eta| < 0.9$



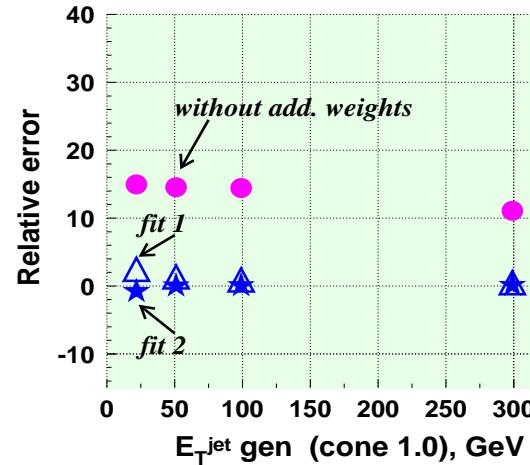
$1.8 < |\eta| < 2.1$

Relative error for R=1

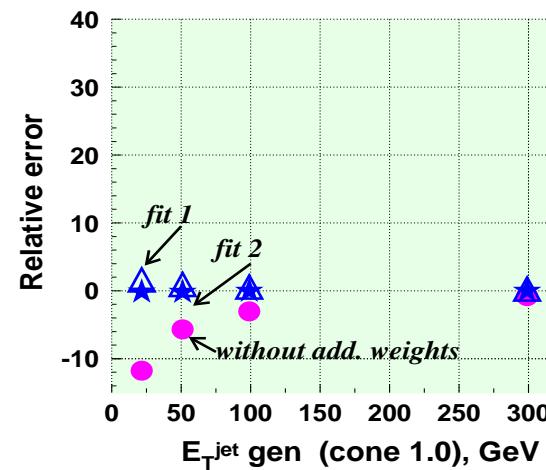
$$error = \frac{\langle E_{T\ jet}^{rec} - E_{T\ jet}^{gen} \rangle}{\langle E_{T\ jet}^{rec} \rangle}$$



$|\eta| < 0.3$



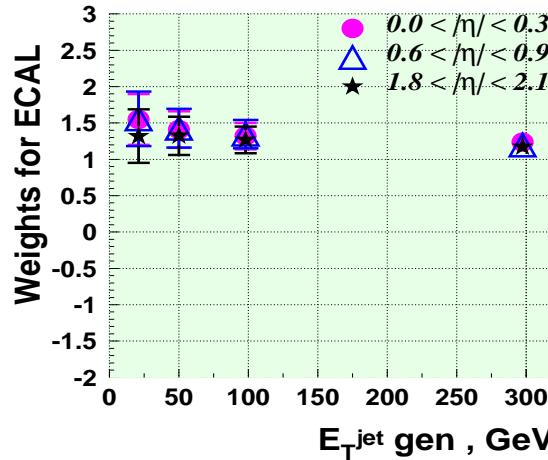
$0.6 < |\eta| < 0.9$



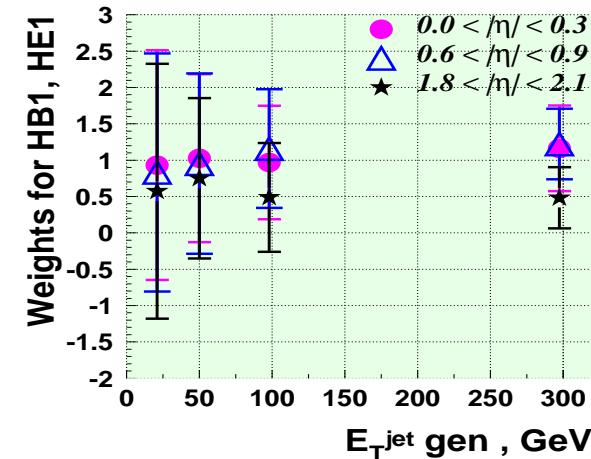
$1.8 < |\eta| < 2.1$

Energy dependance of the readout weights

R=0.5

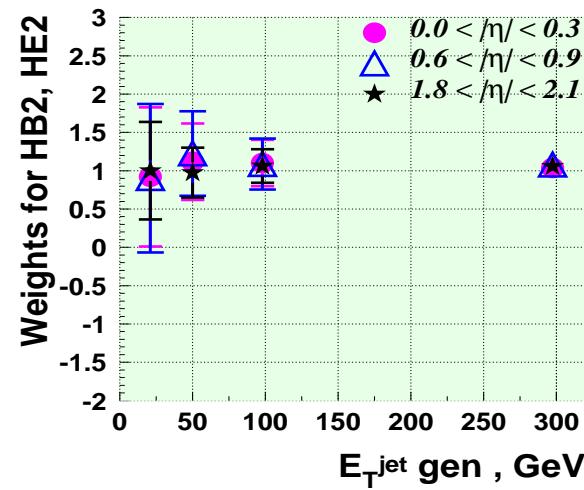


HB1,HE1



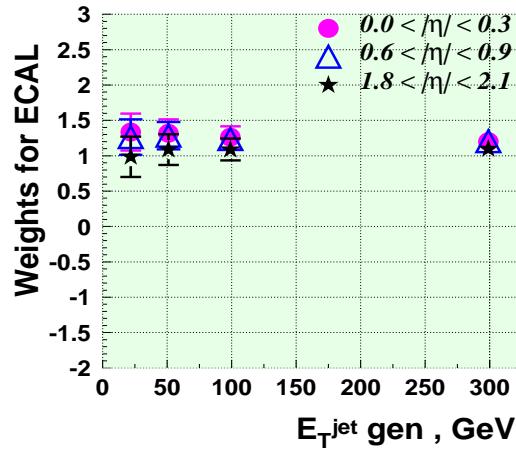
HB2,HE2

ECAL

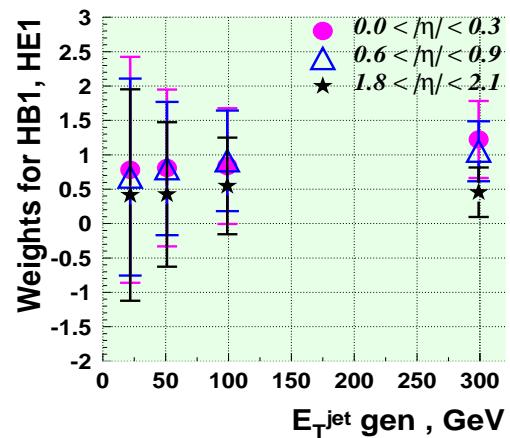


Energy dependance of the readout weights

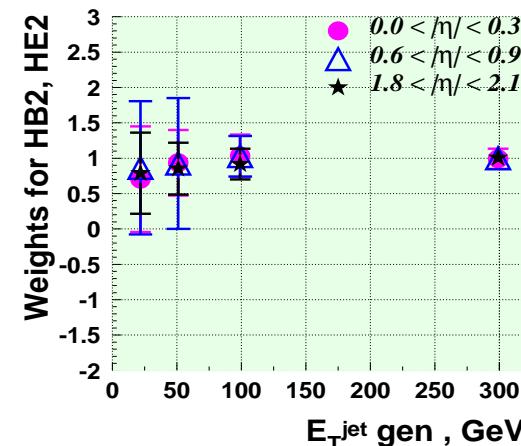
R=1



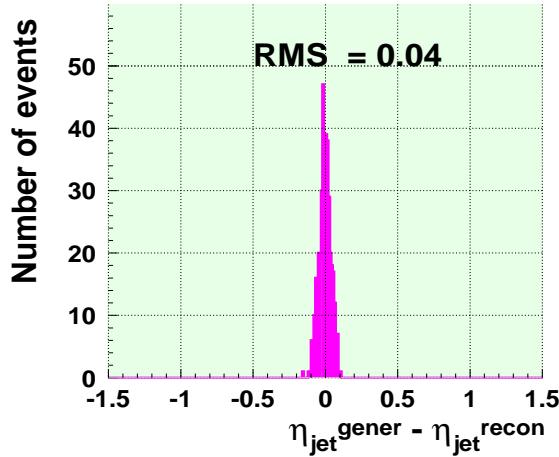
ECAL



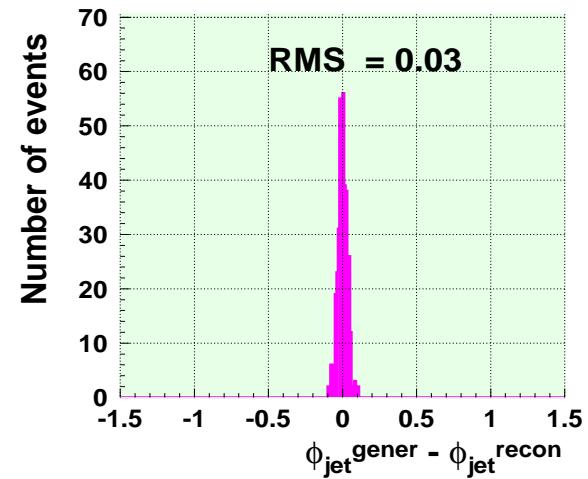
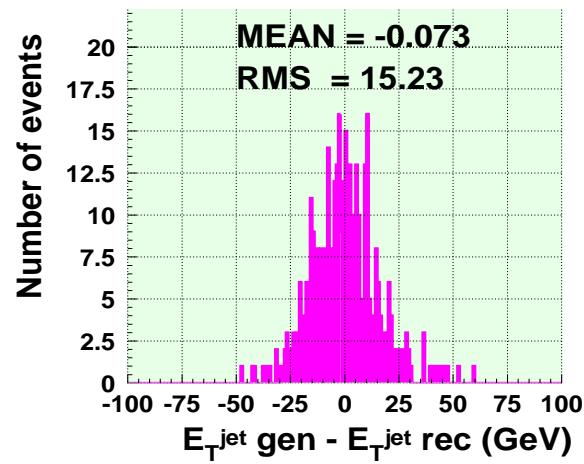
HB2,HE2



Space and energy resolution for 100 GeV jets

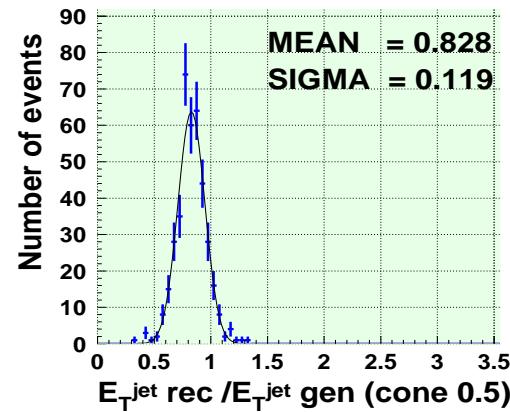


$|\eta| < 0.3$



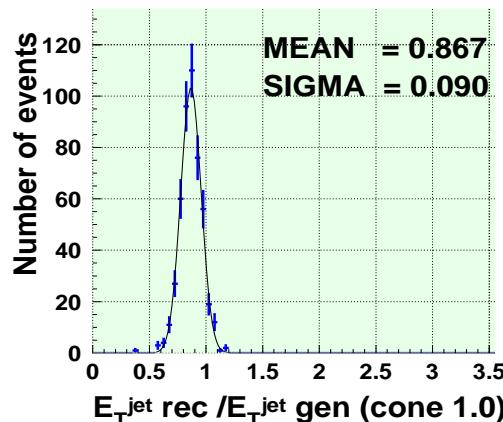
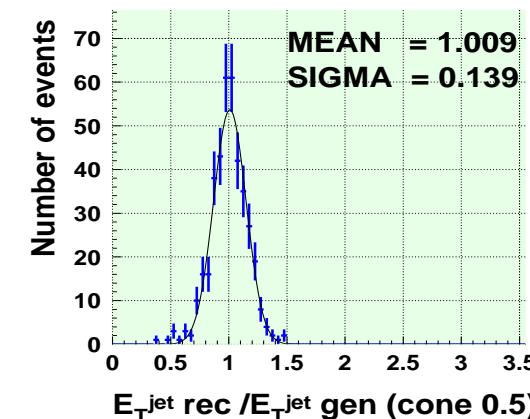
Jet energy resolution for generated jets with $E_T = 100$ GeV

Without weights

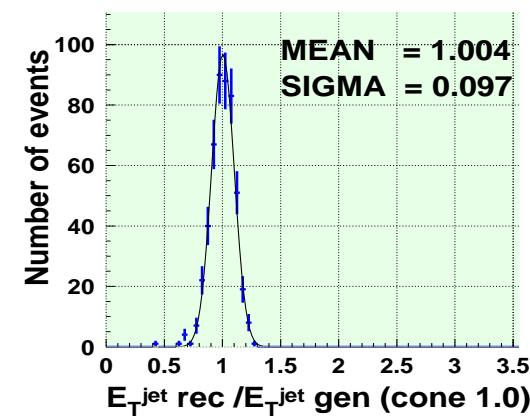


R=0.5

With weights



R=1



Summary

Including weights to calorimeters readout allows to set the mean energy of jets (improving relative error).

There is no significant improvement to the jet energy resolution.

Significant improvement of energy resolution can be achieved by increasing cone size of jet finder for jets with energy less than 200–300 GeV.

Possible solutions:

Look for the jet with cone size 0.5 and gather energy in $R=1$

Including information about charge component from tracker gives the same result.